REMARKS

Status of the claims

Claims 1-14 and 25-53 are pending. Claims 1-14 and 25-53 are rejected. No claims are amended herein.

The 35 U.S.C. §103(a) Rejection

Claims 1-14 and 25-53 are rejected under 35 U.S.C. §103(a) as being obvious over **Sakai** *et al.* (U.S. Patent No. 4,737,824) in view of **WO 01/07691**. Applicants respectfully traverse this rejection.

Sakai *et al.* reference (U.S. 4,737,824)

The Examiner maintains that **Sakai** *et al.* disclose a process for improving the planarity of a substrate support plate for use during a substrate process. The Examiner states that the process comprises adjusting pressure in a hollow core of a shaft below atmospheric pressure to act on the lower surface of the plate while pressure above the top surface acts on the upper surface to improve

the planarity of the substrate during processing (Abstract; col. 2, ll. 30-40; col. 3; col. 4, ll. 10-25; col. 5, ll. 10-23, col. 6, ll. 25-40, col. 7, ll. 65-68; Fig. 2). Also, the Examiner maintains the **Sakai** *et al.* further disclose providing an independently controlled vacuum chucking system (3a-3b in Fig. 2) and monitoring the flatness of the wafer during processing to adjust the pressure so that the desired planarity is achieved (col. 7, ll. 20-35; Fig. 2).

Furthermore, in response to Applicants arguments, filed August 9, 2004, that neither **Sakai** et al. nor **WO 01/07691** disclose improving uniformity of a susceptor supporting a substrate, the Examiner states that **Sakai** et al. teach a part 4a in Figure 2 and a method of providing planarity to the part 4a which is a plate that supports the substrate in the discussion related thereto.

WO 01/07691 reference

The Examiner states that **WO 01/07691** discloses that it is critical to maintain substrates flat during the deposition of epitaxial layers in a deposition chamber at reduced pressure to prevent the edges of the substrate from curling and causing non-uniform coatings thereon (pg. 3, ll. 1-25).

Sakai *et al.* with WO '691 as applied to claims 1, 11, 25, 33, and 36.

The Examiner states that **Sakai** *et al.* teach all the elements of the claimed invention except reducing a pressure in a deposition chamber to a level required for deposition of a film onto the substrate. The Examiner states that **WO 01/07691** remedies this deficiency. Thus, the Examiner states, it would have been prima facie obvious to have performed the method for improving planarity of the substrate in such a reduced pressure deposition chamber to prevent curling of the edges of the substrate during deposition.

The Examiner also maintains that even though neither **Sakai** *et al.* nor **WO 01/07691** explicitly disclose the numerical values of the reduced pressure in the hollow shaft or the deposition chamber or the substrate temperatures, it is well-settled that "where the principal difference between the claimed process and that taught by the reference is a temperature difference, it is incumbent upon applicant to establish criticality of that temperature difference" (*Ex Parte* Khusid 174 USPQ 59). The Examiner states this principle clearly is applicable to other process parameters, such as pressure. Therefore, it is prima facie obvious to use pressures in the claimed range, absent evidence of criticality.

Applicants reiterate that the instant invention discloses methods of planarizing a support plate of a susceptor and methods of film deposition using a planarized susceptor. As compared to Applicants' invention **Sakai** *et al.* disclose a device for changing the shape, including flatness or non-flatness, of a surface of a plate-like member, i.e., a semiconductor wafer (Abstract; col. 1, ll. 6-15; Fig. 1). The plate-like member is not a supportive device nor does it comprise a susceptor. The device comprises a wafer chuck base with an upwardly extending annular support that chucks the periphery of the plate-like member or wafer via a vacuum, electrostatic attraction or mechanical means.

When the wafer is in position on the annular chuck, it defines a sealed circular recess underneath the wafer. A tube running through the base of the wafer chuck connects the circular recess to a vacuum pump and to an air pump. Adjusting the pressure in the recess up or down adjusts the planarity or convexity or concavity of the wafer surface to bring it into a predetermined relationship with a plane in which a pattern or mask will be printed (col. 2, ll. 20-36; col. 2, ll. 64 to col. 4, ll. 39-65).

Sakai et al. disclose that a diaphragm member 4 is positioned in the center of the recess and has an upper wall, i.e., part

4a, and side walls of an elastic material and a lower wall of thin metal and a pressure-controllable chamber. Diaphragm 4 also has a vacuum groove 4b analogous to the wafer chuck groove to insure contact of the underside of a wafer with the elastic surface 4a. In using the device depicted in Figure 2, a substrate is held and supported around the periphery by the wafer chuck (col. 5, ll. 38-43). The elastic part 4a is in intimate contact with the substrate at the center of the wafer via vacuum groove 4b (col. 5, ll. 43-48). The pressure within the chamber of the diaphragm member is adjusted up or down from atmospheric pressure to deform the lower wall outwardly or inwardly which subsequently alters the shape of the elastic upper wall upwardly or downwardly **from the planar** (Applicants' emphasis) to displace the center portion of the wafer to correct the surface shape of the wafer (col. 5, ll. 65 to col. 6, ll. 39).

As compared to Applicants' invention, **WO 01/07691** teaches a method of keeping a wafer flat during deposition of epitaxial layers at reduced chamber pressure to prevent curling of the edges of later deposited epitaxial layers up and away from earlier deposited layers due to temperature differences between the layers (pg. 3, ll. 13-19). **WO 01/07691** discloses a substantially porous wafer carrier with wafer cavities to hold wafers. The wafer carrier is

removably positioned on top of a non-porous susceptor both in connection with a hollow spindle. A vacuum is applied to the underside of the wafers in the wafer cavities through the porous wafer carrier via the hollow spindle to maintain the wafers in a substantially flat orientation within the wafer carrier (Abstract; pg. 7, ll. 24 to pg. 9, ll. 27; Fig. 2).

Both **Sakai** *et al.* and **WO 01/07691** teach methods of keeping a wafer or substrate flat during a substrate processing method by applying a reduced or increased pressure through the support means, i.e., annular wafer chuck or removable porous wafer carrier, respectively, to the underside of the wafer supported thereon. The diaphragm member 4 in **Sakai** et al. may be used with this method of wafer planarizing specifically to planarize the center of the wafer. As such, the part 4a shown in Fig. 2 in **Sakai** et al. is neither a support plate nor comprises a support plate of a susceptor as is known and standard in the art or disclosed in **Sakai** et al. **Sakai** et al. specifically teach that the wafer chuck provides the support for the wafer when the diaphragm member 4 is used. At best in **Sakai** et al., vacuum groove 4b insures intimate contact between the central underside of the wafer and the operative surface or upper surface of the elastic membrane 4a, so that when decreased or increased

pressure within the diaphragm chamber acts to distort the lower wall the elastic membrane 4a and the center of the wafer are displaced downwardly or upwardly simultaneously to improve planarity of the wafer and not the upper wall 4a of the diaphragm member 4.

Additionally, the method of reducing the pressure from atmospheric pressure in the diaphragm chamber via a vacuum results in displacing part 4a from the planar to correct distortions at the center of the wafer until the flatness measuring device determines the wafer, but not the upper wall, is flat. **Sakai** et al. teach that the part 4a is planar at atmospheric pressure. Furthermore, **Sakai** *et al.* teach that the distortion of the lower wall causes the displacement of the upper wall from the planar. Therefore, the pressure in **Sakai** *et al.* is acting on the upper surface of the lower wall defining the chamber and not the lower surface of the upper wall in contact with the center of the wafer. Applicants invention recites that the first reduced pressure acts upon the lower surface of the support plate on the susceptor.

The combination of **Sakai** *et al.* with **WO 01/07691** does not teach nor suggest methods of planarizing a support plate on a susceptor to one of ordinary skill in the art. The teaching in **WO 01/07691** of reducing pressure in the deposition chamber does not

remedy the deficiencies present in **Sakai** *et al.* because neither **Sakai** *et al.* nor **WO 01/07691** teach or suggest reducing the pressure acting upon the lower surface of support plate of a susceptor to improve its planarity. At a minimum, the vacuum pulled on the semiconductor wafers in either **Sakai** *et al.* or **WO 01/07691** cannot act upon the underside of the wafer chuck or the susceptor to improve its planarity because the openings therethrough align with the underside of the wafer. Nor does the vacuum pulled within the chamber of the diaphragm member 4 in Fig. 2 act upon the elastic upper wall 4a to improve its planarity. Therefore, the combination of any elements disclosed in **Sakai** *et al.* and **WO 01/07691** cannot render the instant invention obvious as recited in independent claims 1, 11, 25, 33, and 36.

Claims 2-10, 12-14, 26-32 and 39-43, 34-35 and 44-48, and 37-38 and 49-53 depend directly or indirectly from amended independent claims 1, 11, 25, 33, and 36, respectively, and further limit the invention as recited therein. Thus, these dependent claims are allowable for the reasons stated *supra* in considering amended independent claims 1, 11, 25, 33, and 36, as well as for their respective attributes.

Applicants reiterate that in view of the arguments presented *supra*, the combination of **Sakai** *et al.* with **WO 01/07691** does not teach nor suggest methods of planarizing a support plate on a susceptor nor would one of ordinary skill in the art be motivated to do so in view of the combination without so substantially modifying **Sakai** *et al.* with **WO 01/07691** as to render it unsuitable for its intended purpose. Therefore, as the instant invention, as recited in amended claims 1, 11, 25, 33, and 36 is both novel and non-obvious over the combination of **Sakai** *et al.* and **WO 01/07691**, then dependent claims 2-10, 12-14, 26-32, 34-35, 37-53 also are non-obvious over the combination of **Sakai** *et al.* and **WO 01/07691**. Accordingly, in view of the claim amendments and arguments presented herein, Applicants respectfully request that the rejection of claim 1-14 and 25-53 under 35 U.S.C. §103(a) be withdrawn.

Applicants submit that claims 1-14 and 25-53, as previously presented, are in condition for allowance. Accordingly, Applicants request that claims 1-14 and 25-53 be passed to issuance. This is intended to be a complete response to the Final Office Action mailed October 6, 2004. Applicants submit that the if any issues remain outstanding, the Examiner is respectfully requested to telephone the undersigned attorney of record for immediate

resolution. Applicants believe that no fees are due, however, should this be in error, please debit Deposit Account No. 07-1185 upon which the undersigned is allowed to draw.

Respectfully submitted,

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